Space Weather Technical Forecast

Issued on Saturday, 04 December 2021 at 12:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of G1/Minor Storm activity next 24 hours. Active fluence likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was low, with a long period C4 flare from AR2898, peaking at 04/0515 UTC. There are currently three sunspot regions on the visible disc, and a fourth rotating off the disc. AR2898 is the region rotating off, but was responsible for the recent C-flare. However, its location means it is no longer visible so it is difficult to assess how complex it currently is. AR2902 in the northwest, which has faded significantly, and the new region in the southeast are both classified Axx/Alpha. Another new region near centre disc in the northern hemisphere is a weak Bxo/Beta. No Earth-directed CMEs have been observed in coronagraph imagery, although a CME associated with the C4 flare has been observed. Whilst analysis of this is not yet complete, the location suggests it is unlikely to be Earth directed.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, was slightly elevated to start the period at around 440 km/s. It then increased to elevated levels from 03/2200 UTC, before dropping slightly and is currently around 470 km/s. Density started just above average, peaking at 15 ppcc around 03/1400 UTC, but soon after fell back to average levels. The IMF Bt was generally weak, but did reach 9 nT at 03/1440 UTC and again at 03/2315 UTC. The north-south component Bz, has ranged between +/-8nT, but has varied more weakly since 04/0200 UTC. The Phi angle was predominantly in a positive orientation (away from the Sun). Resultant geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. The high energy electron flux (greater than 2 MeV) was High (greater than 1000 pfu) at first with a peak of 4870 pfu at 03/1520 UTC, then it rapidly dropped below 1000 pfu at 03/1625 UTC, staying at background to Moderate levels since. The associated 24-hour integrated fluence was above the Active threshold (1e8 integrated pfu) for much of the period, dropping below by 04/0600 UTC. Observed fluence at 04/0001 UTC was 1.13e8 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be low reducing to very low, with a 50% chance of C-flares and a 5% chance of M-flares. This is due to AR2898 which is no longer visible on the southwest limb, and will reduce as this region rotates further off the disc.

Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs expected. A very weak CME from a filament eruption on 03 Nov may graze Earth on Day 4 (07 Nov), but this is low confidence and minimal impacts are expected.
Wind speeds are currently slightly elevated, likely due to either CH27/+ or CH28/+. Speeds are expected to gradually decline to background levels through the next 24-48 hours. Geomagnetic activity is currently mainly Unsettled with a slight chance of isolated G1/ Minor Storm intervals over the next 24 hours. Quiet to Unsettled activity is expected thereafter, with a chance of the odd Active interval if any weak CME influence occurs.

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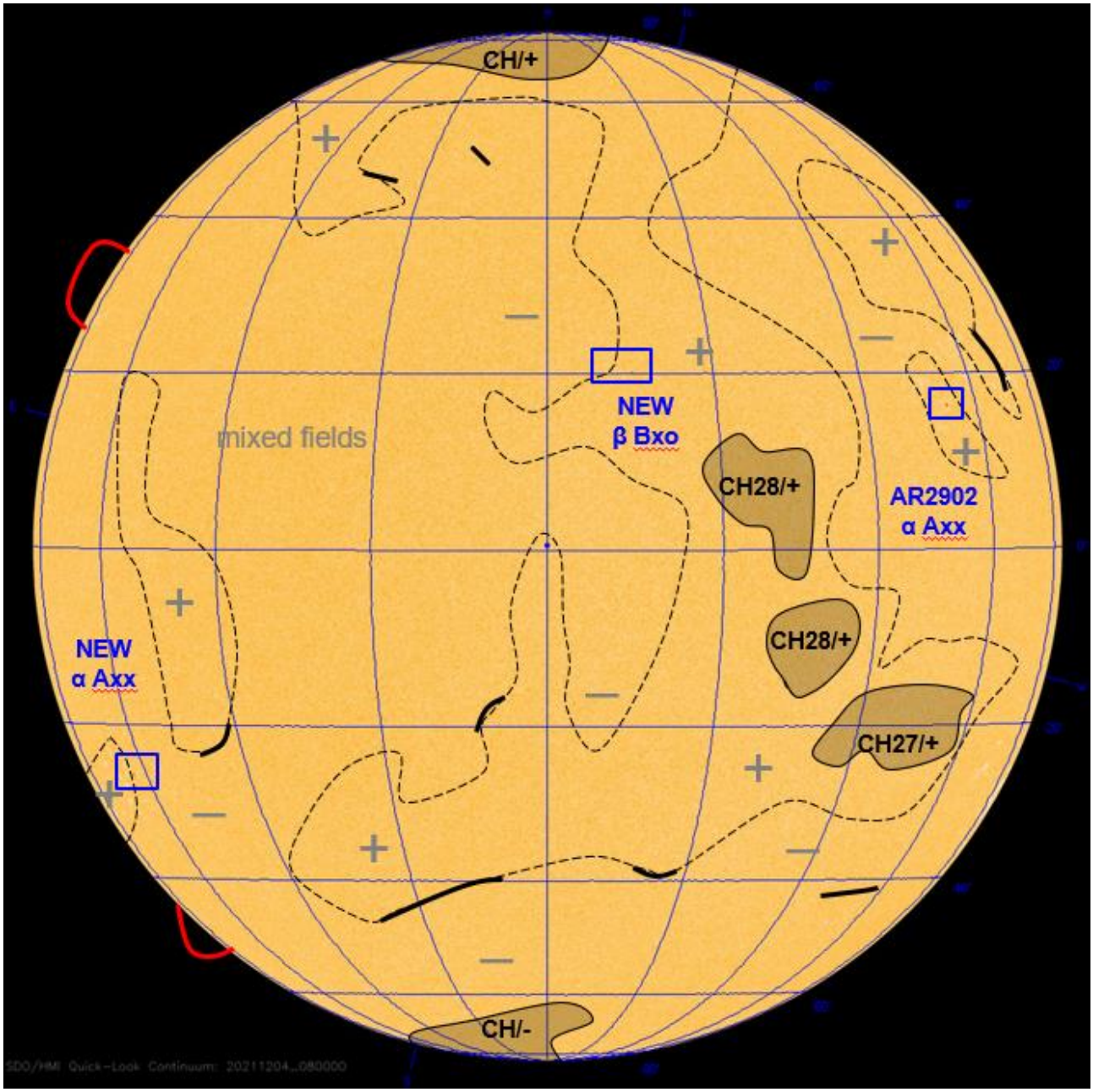
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to return to predominantly High levels. The associated 24 hour integrated fluence is currently just below the Active threshold (1e8 integrated pfu) due to the recent sharp drop in flux levels. Fluence is most likely to become Active again and remain so through this period, although confidence is a little low.

Figure 1. Solar Analysis Valid 04/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

There are currently no Earth-directed CMEs. A very weak CME from a filament eruption on 03 Nov may graze Earth on Day 4 (07 Nov), but this is low confidence and minimal impacts are expected.

Wind speeds are currently slightly elevated, likely due to the high speed stream from either CH27/+ or CH28/+. These coronal holes were only present as a weak feature on the last rotation which didn't really connect. They have become more fragmented into three separate holes in the last 24 hours, so wind speeds are unlikely to go much higher than they already have. As such, wind speeds are expected to gradually decline to background levels through the next 24-48 hours.

Geomagnetic activity is currently mainly Unsettled with a slight chance of isolated G1/ Minor Storm intervals over the next 24 hours due to the influence of CH27 and CH28. Quiet to Unsettled activity is expected thereafter, with a chance of the odd Active interval if any weak CME influence occurs.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	5	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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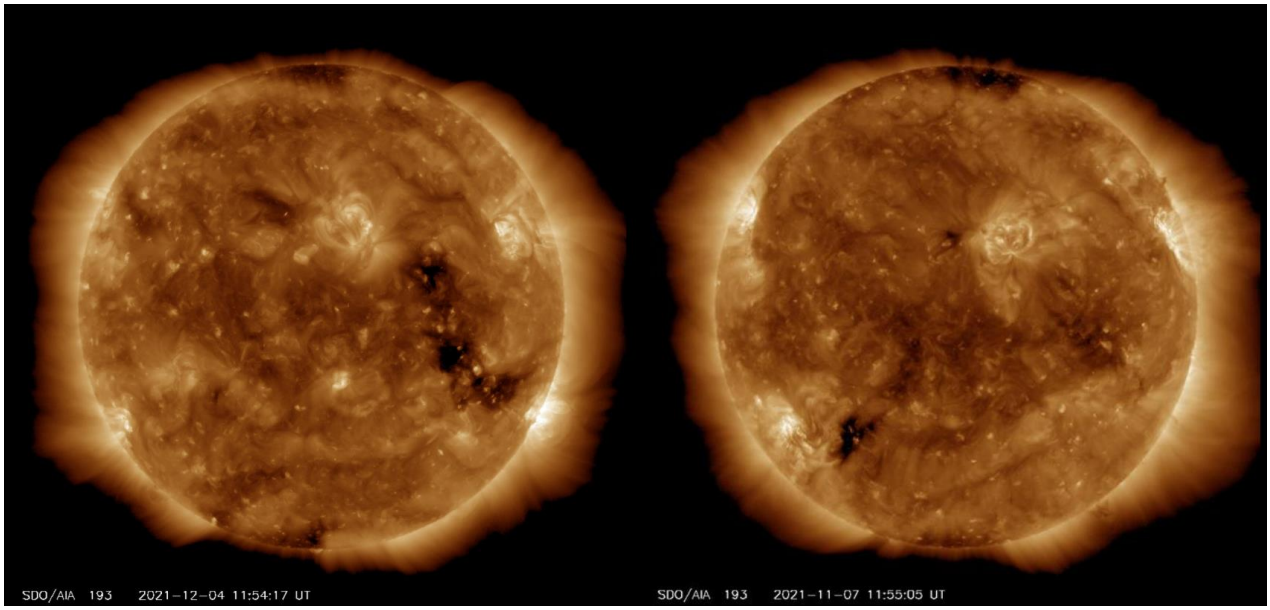
Figure 2: AIA-193 imagery showing coronal holes 27 and 28 in the western hemisphere today (left) and a much smaller weaker feature on the previous rotation (right).



Radio Blackouts - X-Ray Flares:

Solar Activity is currently Low, with a long period C4 flare peaking at 04/0515 UTC from AR2898 on the southwest limb. This region is just off the disc, but showed some signs of development before it became less visible as it reached the limb. It is not possible to assess the current configuration or magnetic complexity as it can't be seen properly any more, but further flares are likely from this region until it is well over the limb. There are currently three other small sunspot regions on the visible disc, all of which are small and simple and unlikely to give significant flaring in their current configurations.
As such, the probability of C-class flares is assessed as 50% with a 5% risk of M-class flares from AR2898. This risk is reducing as the region rotates further off the disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	2	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

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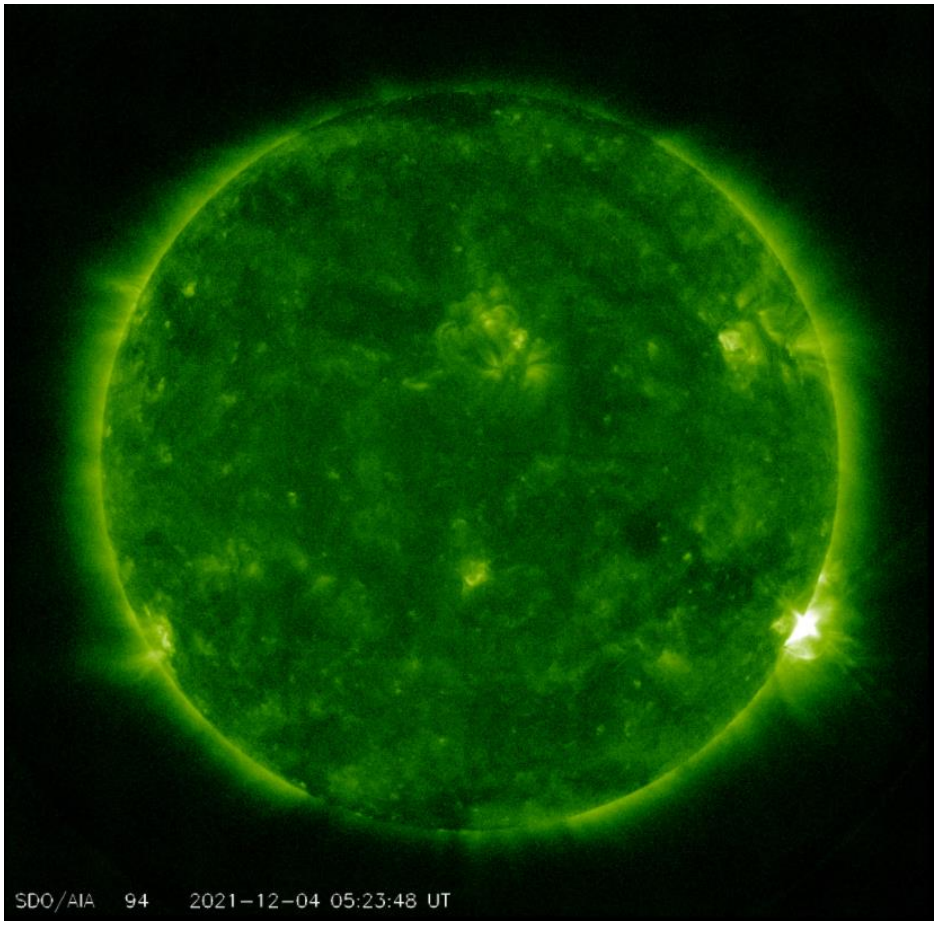
Figure 3: AIA-94 imagery showing the long period C4 flare from AR2898 on the southwest limb



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is forecast to remain at background levels, with no solar radiation storms anticipated.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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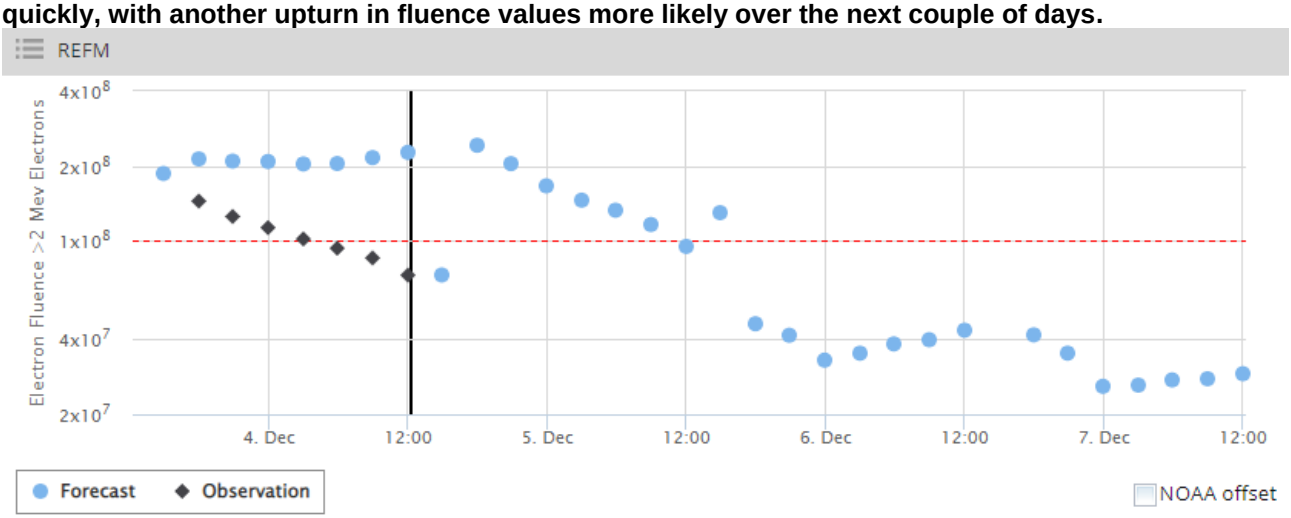
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2 MeV) as observed by GOES-16 showed a sharp drop from the peak on Friday during the UTC evening. This may have been a result of some radiation belt compression with the arrival of the fast wind of CH27/CH28. Wind speeds are already dropping, and it is likely that we will see a recovery in flux values back to High levels over the next 24 hours or so, perhaps with a slight increase as further charging may have occurred.
The associated 24 hour electron fluence is currently just below the Active (greater than 1e8 integrated pfu) threshold due to the recent drop out in flux levels. Confidence for Active fluence is a little low given the recent sharp drop in flux values, but the most likely scenario is a return to Active fluence over the next 24-48 hours, then probably remaining above through Days 3 and 4 (06 and 07 Nov). REFM is suggesting a downward trend from day 2 (5th) but is reducing values too quickly beyond this period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	70	80	70	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	5	5

Figure 5: REFM model showing a downward trend. This is expected to be reducing values too quickly, with another upturn in fluence values more likely over the next couple of days.



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